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The Evaluation System of Online P2P Lending Platforms Based on AHP -- in the Perspective of Lenders

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Abstract: This paper establishes an objective and comprehensive evaluation index system of online P2P lending platforms based on the online P2P lending theory with the Analytic Hierarchy Process in the perspective of lenders. It also makes the empirical analysis which takes ten P2P platforms as examples. The results show that the evaluation system is scientific and reasonable, which can provide references of the rational choice of investment platform for lenders.

Keywords: Online P2P Lending, Online P2P Lending Platforms, Analytic Hierarchy Process

1. INTRODUCTION

Since the 21st century, with the rapid development of the Internet and the mismatch between supply and demand of private funds, online P2P lending has appeared as a new loan model^[1-3]. Online P2P lending refers to the process of matching funds between both lenders and borrowers through online P2P lending platforms^[4-6]. However, along with the increasing number of P2P platforms, lenders faces increasing risks in the investment process: market confusion, lack of supervision and industrial self-regulation, imperfect evaluation system and so on. All these risks make adverse impact on lenders to make rational decisions on choosing lending platforms^[7-11]. Therefore, the confidence of lenders on the network lending platform will reduced, and the national normal financial order will be degraded^[12]. It becomes an urgent problem that how to choose lending platforms and gain maximize revenue for lenders.

Therefore, it is necessary to establish a set of integrated and comprehensive evaluation index system which guides lenders to choose network platforms. It is not only giving the lending platforms objectively and comprehensively evaluation and making rational choices of lending platforms for lenders, but also providing fair competition opportunities for platforms, which is conducive to the professional development of the P2P online lending industry.

2. EVALUATION MODEL OF ONLINE P2P LENDING PLATFORMS BASED ON AHP

2.1 The Evaluation Perspective of Online P2P Lending Platforms

This paper designs online P2P lending platforms evaluation index system in the perspective of lenders. The lenders on P2P lending platforms are the main target group who seek investment opportunities for profit^[13]. Online P2P lending platforms are a new investment model for them^[14]. It has profound reasons of choosing lenders as the research perspective: firstly, with the continuous development of online P2P lending industry as well as the increasing number of P2P lending platforms, the number of lenders also appeared explosive growth. secondly, the lost from the adverse platforms is growing with the increasing number of lenders.

2.2 Designing of Index System

The literature on the evaluation index system of online P2P lending platform is much limited. Wangdaizhijia (WDZJ)^[15], the industrial spontaneous-formed evaluation organization, formed its own evaluation index system which lacks of the starting point, and each index has the same weight. As a result, the calculation result of platform's comprehensive index is only the overall situation of a P2P lending platform which ignores the

security of the platform and will be useless to lenders.

Therefore, on the basis of the existing evaluation indexes, this paper improves the evaluation index by analyzing the similarities and differences of some online P2P lending platforms in China under the principles of comprehensive, systematic, feasibility and applicability. First-hand data is obtained and analyzed through the questionnaire survey that conducted by online P2P lending lenders. Some views of experts and scholars of the industry as well as platform executives are taken into consideration for the reasonability of research. The evaluation index system of P2P lending platforms is shown in Figure 1.

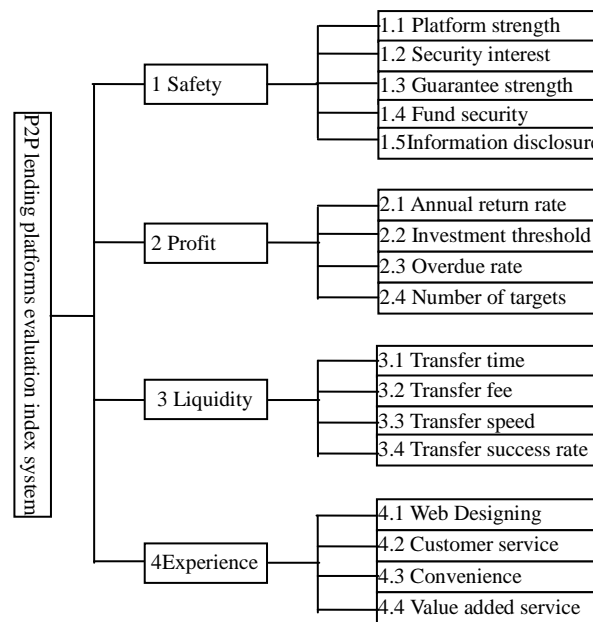


Figure 1. Evaluation index system of P2P lending platform

2.3 Determination of Index Weight

2.3.1 Establishing the Weight Matrix

The judgment matrix is the basis of analytic hierarchy process, and also the important basis for the calculation of relative importance degree. The element U_{ij} determines the relative importance of element J and factor I in U , and $U_{ij} = 1/U_{ji}$, $U_{ii} = 1$. The 1-9 scale method is introduced to quantify the comparative judgment, which is shown in Table 1.

Table 1. 1-9 Scale

scale	Definitions (i and j)
1	Element i is as important as j.
3	Element i is slightly more important than j.
5	Element i is more important than j.
7	Element i is strongly weight than j.
9	Element i is absolutely important than j.
2,4,6,8	Intermediate values of adjacent elements of judgment.
Reverse	When comparing the elements of j and i.

The two relative importances of elements in hierarchical analysis method are generally given by the expert scoring. In this thesis, the relative importance of the two elements is obtained by the questionnaire survey.

Table 2. Comparison results of criteria layer index

Importance	U1	U2	U3	U4
U1	1	3	7	5
U2	1/3	1	5	3
U3	1/7	1/5	1	1/3
U4	1/5	1/3	3	1

Table 3. Comparison results of layer U1 index

Importance degree	U11	U12	U13	U14	U15
U11	1	1	5	1	3
U12	1	1	5	1	3
U13	1/5	1/5	1	1/5	1/3
U14	1	1	5	1	3
U15	1/3	1/3	3	1/3	1

Table 4. Comparison results of layer U2 index

Importance degree	U21	U22	U23	U24
U21	1	9	5	7
U22	1/9	1	1/5	1/3
U23	1/5	5	1	3
U24	1/7	3	1/3	1

Table 5. Comparison results of layer U3 index

Importance degree	U31	U32	U33	U34
U31	1	1	1/5	1/3
U32	1	1	1/5	1/3
U33	5	5	1	3
U34	3	3	1/3	1

Table 6. Comparison results of layer U4 index

Importance degree	U41	U42	U43	U44
U41	1	1/5	3	3
U42	5	1	7	7
U43	1/3	1/7	1	1
U44	1/3	1/7	1	1

2.3.2 Calculation of Weight

In theory, the relative importance of the same level elements is obtained by calculating the eigenvalues of U, but the calculation method is more complex, and it can only get a rough estimate of U. Therefore, it is not necessary to calculate the exact eigenvalues^[16], so approximate eigenvalues can be calculated by summation or root value of law in practice. Root-finding: calculate the results of the judgment matrices of all the elements in each row of m_i ; calculate its n root mean square: $V_i = \sqrt[n]{m_i}$; normalization: $W_i = V_i / \sum V_i$.

According to the root method above, we can calculate the weight of the primary evaluation index in U matrix. That is the weight of safety, profit, mobility and experience.

$$U = \begin{bmatrix} 1 & 3 & 7 & 5 \\ 1/3 & 1 & 5 & 3 \\ 1/7 & 1/5 & 1 & 1/3 \\ 1/5 & 1/3 & 3 & 1 \end{bmatrix}, V_0 = \begin{bmatrix} 3.20 \\ 1.50 \\ 0.31 \\ 0.67 \end{bmatrix}, W_0 = \begin{bmatrix} 0.56 \\ 0.26 \\ 0.06 \\ 0.12 \end{bmatrix}$$

As shown above, the weight of security, profit, mobility experience is (0.56, 0.26, 0.06, 0.12).

Similarly,

$$W_1 = \begin{bmatrix} 0.28 \\ 0.28 \\ 0.05 \\ 0.28 \\ 0.11 \end{bmatrix}, W_2 = \begin{bmatrix} 0.65 \\ 0.05 \\ 0.21 \\ 0.09 \end{bmatrix}, W_3 = \begin{bmatrix} 0.10 \\ 0.10 \\ 0.55 \\ 0.25 \end{bmatrix}, W_4 = \begin{bmatrix} 0.19 \\ 0.65 \\ 0.08 \\ 0.08 \end{bmatrix}$$

So, the weights of U11, U13, U12, U14 is (0.28, 0.28, 0.05, 0.28, 0.11); U21, U23, U22, U24 is (0.65, 0.05, 0.21, 0.09); the weights of U31, U32, U33, U34 is (0.10, 0.10, 0.55, 0.25); the weights of U41, U42, U43, U44 is (0.19, 0.65, 0.08, 0.08).

2.3.3 Conformance Test

In order to avoid logic error, for example, the U1 is more important than U2, and U2 is more important than U3, but U3 is more important than U1, It is necessary to test the consistency of the judgment matrix^[17]. In the first level indicator:

$$\begin{bmatrix} 1 & 3 & 7 & 5 \\ 1/3 & 1 & 5 & 3 \\ 1/7 & 1/5 & 1 & 1/3 \\ 1/5 & 1/3 & 3 & 1 \end{bmatrix} \begin{bmatrix} 0.56 \\ 0.26 \\ 0.06 \\ 0.12 \end{bmatrix} = \begin{bmatrix} 2.36 \\ 1.11 \\ 0.23 \\ 0.50 \end{bmatrix}$$

$$\lambda_{\max} = \frac{1}{n} \sum_i \frac{(UW)_i}{W_i} = \frac{1}{4} \left(\frac{2.36}{0.56} + \frac{1.11}{0.26} + \frac{0.23}{0.06} + \frac{0.50}{0.12} \right) = 4.0925$$

$$CI = \frac{\lambda_{\max} - n}{n-1} = \frac{4.0925 - 4}{4-1} = 0.031$$

After querying the same order Mean Random Consistency Index, we find RI = 0.9, so CR = CI/RI = 0.031/0.9 = 0.034 < 0.1, and the conformance test is acceptable. Similarly, the consistency of the second level indicators is acceptable. Therefore, the evaluation index and weight of online P2P lending platform are shown in the following table 7.

Table 7. The evaluation index and weight of online P2P lending platform

object level	criteria level	indicator level
P2P lending platforms evaluation index U	Safety U1 (0.56)	Platform strength (0.28)
		Security interest (0.28)
		Guarantee strength (0.5)
		Fund security (0.28)
		Information disclosure (0.11)
	Profit U2(0.26)	Annual return rate (0.65)
		Investment threshold (0.05)
		Overdue rate (0.21)
		Number of targets (0.09)
	Liquidity U3 (0.06)	Transfer time (0.10)
		Transfer fee (0.10)
		Transfer speed (0.55)
		Transfer success rate (0.25)
	Experience U4(0.12)	Web Designing (0.19)
		Customer service (0.65)
		Convenience (0.08)
		Value added service (0.08)

3. EMPIRICAL RESEARCH ON THE EVALUATION INDEX SYSTEM OF ONLINE P2P LENDING PLATFORM

3.1 Platforms of Empirical Research

The top 10 online P2P lending platform in WDZJ will be analyzed by using the above evaluation index system and fuzzy comprehensive evaluation. Comparative analysis will be carried out between the analyzed results and the actual ranking in WDZJ.

Online P2P lending platform ranking in WDZJ is taken into consideration when selecting the platforms. In WDZJ, the platforms have different rankings based on turnover, net income, loan popularity, borrowing popularity and revenue^[18]. The evaluation index system in this thesis is inclined to the evaluation and selection of lenders while the ranking in WDZJ reflects the operating performance of platforms. So, the top 10 loan popularity platforms will be reevaluated. They are Paipaidai(P), Renrendai(R), Honglingchuangtou(H), Weidaiwang(WD), Yirendai(YR), Wenzhoudai(WZ), 365yidai(365), Youliwang(YL), 808xindai(808), and Shengrongzaixian(S).

3.2 Evaluation of Online P2P Lending Platform based on Level Analyses and Fuzzy Evaluation

3.2.1 Establishment of Fuzzy Comprehensive Judgment Table

Before the empirical analysis, fuzzy comprehensive judgment table should also be built in addition to select the appropriate platform. The established evaluation index has two levels: The first level is (1).

$$U=\{U_1, U_2, U_3, U_4\} \quad (1)$$

The second level is (2)(3)(4)(5).

$$U_1=\{U_{11}, U_{12}, U_{13}, U_{14}, U_{15}\}; \quad (2)$$

$$U_2=\{U_{21}, U_{22}, U_{23}, U_{24}\}; \quad (3)$$

$$U_3=\{U_{31}, U_{32}, U_{33}, U_{34}\}; \quad (4)$$

$$U_4=\{U_{41}, U_{42}, U_{43}, U_{44}\}. \quad (5)$$

The established evaluation index includes both quantitative and qualitative components, so, quantitative evaluation set has been designed to transform qualitative evaluation into quantitative

evaluation in table 8. Each indicator has a score to define the quality of the case (sample) platforms.

Fuzzy comprehensive judgment table has been obtained after the analysis of the above 10 online P2P lending platforms is shown in table 9.

Table 8. Evaluation set

Comment set	Very good	Good	General	Poor	Very poor
Quantitative score	0.9	0.7	0.5	0.3	0.1

Table 9. Fuzzy comprehensive judgment table

index	P	R	H	WD	YR	WZ	365	YL	808	S
1	1.1	0.9	0.9	0.9	0.5	0.9	0.9	0.7	0.7	0.7
	1.2	0.3	0.9	0.5	0.9	0.7	0.5	0.9	0.9	0.7
	1.3	0.3	0.7	0.9	0.9	0.7	0.5	0.5	0.7	0.5
	1.4	0.9	0.9	0.9	0.9	0.7	0.5	0.7	0.9	0.7
	1.5	0.7	0.9	0.9	0.9	0.7	0.7	0.9	0.5	0.5
2	2.1	0.7	0.7	0.5	0.7	0.5	0.5	0.7	0.5	0.5
	2.2	0.5	0.7	0.7	0.9	0.7	0.9	0.7	0.9	0.9
	2.3	0.9	0.9	0.7	0.9	0.7	0.7	0.9	0.7	0.5
	2.4	0.9	0.9	0.9	0.7	0.9	0.9	0.5	0.9	0.5
3	3.1	0.1	0.5	0.7	0.1	0.5	0.1	0.1	0.9	0.5
	3.2	0.1	0.7	0.7	0.1	0.7	0.1	0.1	0.9	0.7
	3.3	0.1	0.9	0.9	0.1	0.9	0.1	0.1	0.7	0.7
	3.4	0.1	0.9	0.9	0.1	0.9	0.1	0.1	0.9	0.9
4	4.1	0.9	0.9	0.7	0.9	0.9	0.7	0.7	0.9	0.3
	4.2	0.9	0.9	0.9	0.7	0.9	0.7	0.9	0.9	0.9
	4.3	0.7	0.9	0.9	0.7	0.9	0.9	0.5	0.9	0.7
	4.4	0.9	0.7	0.7	0.7	0.9	0.9	0.5	0.5	0.5

Note: the numbers are corresponding with the index in Figure 1.

3.2.2 Comprehensive Evaluation in Different Levels

$U1=(U11, U12, U13, U14, U15)$, $W1=(0.28, 0.28, 0.05, 0.28, 0.11)$, and $R1$ shows the single factor judgment matrix which is composed of $U11, U12, U14, U13, U15$.

$$R1 = \begin{bmatrix} 0.9 & 0.9 & 0.9 & 0.5 & 0.9 & 0.9 & 0.9 & 0.7 & 0.7 & 0.7 \\ 0.3 & 0.9 & 0.5 & 0.9 & 0.7 & 0.5 & 0.9 & 0.9 & 0.9 & 0.7 \\ 0.3 & 0.7 & 0.9 & 0.9 & 0.7 & 0.5 & 0.5 & 0.7 & 0.5 & 0.5 \\ 0.9 & 0.9 & 0.9 & 0.9 & 0.7 & 0.5 & 0.7 & 0.9 & 0.7 & 0.5 \\ 0.7 & 0.9 & 0.9 & 0.9 & 0.7 & 0.7 & 0.9 & 0.5 & 0.5 & 0.5 \end{bmatrix},$$

$$B1 = W1 * R1 = (0.68, 0.89, 0.78, 0.78, 0.756, 0.634, 0.824, 0.79, 0.724, 0.612).$$

Similarly, $W2 = (0.6, 0.05, 0.21, 0.09)$,

$$R2 = \begin{bmatrix} 0.7 & 0.7 & 0.5 & 0.7 & 0.5 & 0.5 & 0.7 & 0.5 & 0.5 & 0.1 \\ 0.5 & 0.7 & 0.7 & 0.9 & 0.7 & 0.9 & 0.7 & 0.9 & 0.9 & 0.9 \\ 0.9 & 0.9 & 0.7 & 0.9 & 0.7 & 0.7 & 0.9 & 0.7 & 0.5 & 0.5 \\ 0.9 & 0.9 & 0.9 & 0.7 & 0.9 & 0.9 & 0.5 & 0.9 & 0.5 & 0.7 \end{bmatrix},$$

$$B2 = W2 * R2 = (0.75, 0.76, 0.588, 0.752, 0.588, 0.598, 0.724, 0.598, 0.52, 0.278);$$

$W3 = (0.10, 0.10, 0.55, 0.25)$,

$$R3 = \begin{bmatrix} 0.1 & 0.5 & 0.7 & 0.1 & 0.5 & 0.1 & 0.1 & 0.9 & 0.5 & 0.1 \\ 0.1 & 0.7 & 0.7 & 0.1 & 0.7 & 0.1 & 0.1 & 0.9 & 0.7 & 0.1 \\ 0.1 & 0.9 & 0.9 & 0.1 & 0.9 & 0.1 & 0.1 & 0.7 & 0.7 & 0.1 \\ 0.1 & 0.9 & 0.9 & 0.1 & 0.9 & 0.1 & 0.1 & 0.9 & 0.9 & 0.1 \end{bmatrix},$$

$$B3 = W3 * R3 = (0.1, 0.84, 0.86, 0.1, 0.84, 0.1, 0.1, 0.79, 0.73, 0.1);$$

$W4 = (0.19, 0.65, 0.08, 0.08)$,

$$R4 = \begin{bmatrix} 0.9 & 0.9 & 0.7 & 0.9 & 0.9 & 0.7 & 0.7 & 0.9 & 0.3 & 0.1 \\ 0.9 & 0.9 & 0.9 & 0.7 & 0.9 & 0.7 & 0.9 & 0.9 & 0.9 & 0.7 \\ 0.7 & 0.9 & 0.9 & 0.7 & 0.9 & 0.9 & 0.5 & 0.9 & 0.7 & 0.9 \\ 0.9 & 0.7 & 0.7 & 0.7 & 0.9 & 0.9 & 0.5 & 0.5 & 0.5 & 0.7 \end{bmatrix},$$

$$B4 = W4 * R4 = (0.884, 0.884, 0.846, 0.738, 0.9, 0.732, 0.798, 0.868, 0.738, 0.602).$$

3.2.3 High Level Comprehensive Evaluation

$$U = (U1, U2, U3, U4),$$

$$B = W_0 * R = W_0 * \begin{bmatrix} B1 \\ B2 \\ B3 \\ B4 \end{bmatrix} = (0.56, 0.26, 0.06, 0.12)^*,$$

$$\begin{bmatrix} 0.680 & 0.890 & 0.788 & 0.780 & 0.756 & 0.634 & 0.824 & 0.790 & 0.724 & 0.612 \\ 0.756 & 0.760 & 0.588 & 0.752 & 0.588 & 0.598 & 0.724 & 0.598 & 0.520 & 0.278 \\ 0.100 & 0.840 & 0.860 & 0.100 & 0.840 & 0.100 & 0.100 & 0.790 & 0.730 & 0.100 \\ 0.884 & 0.884 & 0.846 & 0.738 & 0.900 & 0.732 & 0.798 & 0.868 & 0.738 & 0.602 \end{bmatrix}$$

$$= (0.69, 0.85, 0.75, 0.73, 0.72, 0.60, 0.75, 0.75, 0.67, 0.49).$$

After the calculation of comprehensive evaluation method, the comprehensive rank of 10 online lending platforms is as follows R, H, YL, 365, WD, YR, P, 808, WZ, S.

4. CONCLUSIONS

By comparing with the existing results, it can be found that the two kinds of sorting results has obviously

different results because of the different evaluation index and the evaluation methods. The reasons are the following: firstly, the rating index in WDZJ are not for lenders, and the evaluation results only reflect the comprehensive influence of platforms; secondly, each evaluation index in WDZJ has same weight, so the relative importance of each index as well as the actual preference of lenders is not distinguished.

Therefore, the evaluation index system using fuzzy AHP based on the lenders is more advantageous to provide the guidance for lenders. For example, Paipaidai has been in the first place in WDZH, and partly because it is China's first online P2P lending platform and its industrial influence is incomparable. However, the investment risk is transferred to the lenders because it focuses on online. So Paipaidai is no longer the preferred platform for lenders in the evaluation based on the perspective of lenders.

So, the evaluation index system in this thesis is more objective and targeted, which is advantageous to lenders' investments and the continuous development of online P2P lending industry.

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